Translation of Claims and paragraphs [0006] to [0010] of JP-A-5-34543

[Claims]

[Claim 1] A temperature sensor accommodating a heat-sensitive element in a protective tube, wherein the internal dimensions of the protective tube are made so that the internal dimension in the direction perpendicular to the most effective heat-sensitive plane of the heat-sensitive element is less than that in the direction parallel to the most effective heat-sensitive plane of the heat-sensitive element.

[Claim 2] A temperature sensor set forth in Claim 1 wherein the heat-sensitive element is accommodated in the protective tube in such a manner that the distance between the heat-sensitive element and the inner surface facing to the element of the protective tube is the shortest at least at one of the most effective heat-sensitive planes of the heat-sensitive element.

[Claim 3] A temperature sensor set forth in either Claim 1 or Claim 2, wherein the spacing between the heat-sensitive element and the protective tube is filled with an amorphous heat-resistant material.

[0006]

[EXAMPLES]

Based on the examples illustrated in the attached drawings, the constitutions of the present utility model are specifically described in the following. Fig. 1 is a diagram showing one example of the structure of a temperature sensor configured with use of a disk-type heat-sensitive element according to the present utility model; Fig. 1(a) is a vertical cross-sectional view, while Fig. 1(b) is a cross-sectional view of Fig. 1(a) cut at plane A-A. Fig. 2 is a bird-eye view illustrating how heat-sensitive elements of various shapes are accommodated in protective tubes wherein the sealed end of the protective tube is only shown with a part of the tube being omitted.

[0007]

The sealed end side of a protective tube 1 made of a heat-resistant metal (e.g., SUS-310S) was subjected to a processing (e.g., smashing by means of a press) for forming a heat-accepting plane 5 in conformity with the shape of a heat-sensitive element 2a comprising an oxygen ion-conductive solid electrolyte, whereby the internal dimension of the protective tube in the direction perpendicular to the most effective heat-sensitive plane 3 or 3′ of the heat-sensitive element 2a was made less than that in the direction parallel to the most effective heat-sensitive plane 3 or 3′. In the tube thus fabricated, the heat-sensitive element 2a was accommodated as shown in Fig. 2(a). And, after an alumina powder

as an amorphous heat-resistant material 6 was filled in the spacing formed by the heat-sensitive element 2a and the protective tube 1, an insulating supporting body 7 of the heat-sensitive element 2a was bonded to the protective tube 1 with use of a heat-resistant inorganic adhesive 8. In this operation, adjustments of the position as well as the direction of each part were performed so that the distance between the heat-sensitive element 2a and the protective tube facing thereto becomes minimal at the most effective heat-sensitive plane 3 or 3'. In addition, a lead 9 for taking out the electric output of the heat-sensitive element 2a was connected to a circuit chord 10 fitted in the open-end side of the protective tube 1 to complete a temperature sensor 12.

[0008]

Further, a bird-eye view of a temperature sensor as an example using a heat-sensitive element of another shape in the present utility model is illustrated in Fig. 2(b) in which a membrane-type heat-sensitive element 2b is accommodated in a protective tube. Details of this configuration, which is substantially common to the example depicted in Fig. 1, are abbreviated.

[0009]

Fig. 4 is a graph showing the result of comparing the thermal response characteristics of the temperature sensor in the foregoing example with those of a conventional temperature

sensor. It has been confirmed that the temperature sensor of the present utility model has a response time curtailed to about 3/4 compared to that of the conventional temperature sensor, indicating a marked improvement of thermal response characteristics.

[0010]

The heat-sensitive element used in the present utility model includes any of publicly known shapes such as of bead, horseshoe, cylinder, etc. In addition, though an effect of raising thermal responsiveness can be attained without filling an amorphous heat-resistant material in the spacing formed by the heat-sensitive element and the protective tube, filling an amorphous heat-resistant material is more preferred since an enhanced effect can be achieved. The amorphous heat-resistant material to be filled includes, in addition to alumina adopted in the example, various ceramics such as spinelle, magnesia, beryllia, silicon nitride, silicon carbide, etc., heat-resistant and oxidation-resistant metals. With respect to the shape of the amorphous heat-resistant material, fibers, whiskers, etc. can be appropriately used. For the purpose of achieving an excellent thermal responsiveness, materials with thermal conductivities as high as possible are preferred. However, in case where the material is filled up to the portion where the metallic terminal of the heat-sensitive element gets in contact, an insulating material is chosen for use.